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Activity 5:

Earthquakes, Volcanoes and Faults in Africa

Map of East Africa showing some of the historically active volcanoes (red triangles) and the Afar Triangle (shaded, center) -- a so-called triple junction (or triple point), where three plates are pulling away from one another: the Arabian Plate, and the two parts of the African Plate (the Nubian and the Somalian) splitting along the East African Rift Zone.

In East Africa, spreading processes have already torn Saudi Arabia away from the rest of the African continent, forming the Red Sea. The actively splitting African Plate and the Arabian Plate meet in what geologists call a triple junction, where the Red Sea meets the Gulf of Aden. A new spreading center may be developing under Africa along the East African Rift Zone. When the continental crust stretches beyond its limits, tension cracks begin to appear on the Earth's surface. Magma rises and squeezes through the widening cracks, sometimes to erupt and form volcanoes. The rising magma, whether or not it erupts, puts more pressure on the crust to produce additional fractures and, ultimately, the rift zone.

For more information, visit: http://pubs.usgs.gov/publications/text/understanding.html

In this exercise, you will examine the location of earthquakes and volcanoes in relationship to faults in Africa. You will also look at the impact on countries in Africa.

Note: New ArcView instructions will be explained in this Exercise. Please refer to Activities 1 through 4 for ArcView instructions that you have already completed.

ArcView Steps

Step 1   Start ArcView and start a project

　Open ArcView GIS by accessing the ArcView shortcut or through the Programs Menu:

Choose the project that you have been working on:

In the Student temporary folder, look for the file "your team name.apr".

In this activity, you will be creating new files. You will want to save your work to a directory on your hard drive. To change the default directory, click "File" and choose "Set Working Directory" from the pulldown menu. Type the path to the directory where you will save your work. This should be the "student temporary" directory, then click OK.

Step 2   Create a new View

Click on Views in the project window on the left side, and click on "new."

Click on the View pulldown menu at the top. Choose "Properties", and rename the view to "Faults, Earthquakes and Volcanoes in Africa". Select "decimal degrees" from the Map Units pull down list . Select "kilometers" from the Distance Units pull down list. Click on Projection and check to make sure the Category is "Projections of the World" and the Type is "Geographic". Click OK.

Step 3   Add Africa Countries, Earthquakes, Volcanoes, Recent Volcanoes, Plate Boundaries and Faults to the view.

Add the following themes to the view from your Africa folder:
　　afr_eq.shp
　　volrecen.shp
　　volafr.shp

The afr_eq.shp contains earthquakes greater than or equal to magnitude 6.5 on the continent of Africa.

The volrecen.shp file only lists the last eruption of volcanoes that have been

active within the last 50 years on the continent of Africa. The volafr.shp file contains all known volcanoes in historic and modern time periods on the continent of Africa.

Add the following themes to the view from the esri_dat directory:
country.shp
faults.shp
popden.shp

The country.shp file contains the outlines of countries in Africa.

The faults.shp file contains faults in Africa. A fault is a thin zone of crushed rock between two blocks of rock, and can be any length, from centimeters to thousands of kilometers.

The popden.shp file contains population density information for Africa.

Step 4   Rename the Themes

Rename the afr_eq.shp theme to Earthquakes6
Rename the volrecen.shp theme to Recent Volcanoes
Rename the volsmith.shp theme to Historic Volcanoes
Rename the faul_afr.shp theme to Faults
Rename the popden.shp theme to Population Density

Step 5   Display the Africa Faults as Unique Values

Double-click on the Africa Faults theme to bring up the Legend Editor. In the Legend Editor window select "Unique Value" as the Legend Type. Select "Type" for the Values Field. Double-click on the line symbol next to the value "rift" to bring up the Pen Palette. In the Pen Palette window change the size to 2. Click on the paintbrush icon to bring up the Color Palette. From the Color Palette choose a bright green. Leave the Legend Editor open.

In the Legend Editor window double-click on the line symbol next to the value "thrust". In the Pen Palette change the size to 2. Click on the paintbrush icon to bring up the Color Palette. From the Color Palette choose a light blue. Click Apply in the Legend Editor to apply your changes to the view. Leave the Legend Editor open.

Step 6   Display the Population Density Theme as a Graduated Color

Double-click on the Population Density theme to bring up the Legend Editor. In the Legend Editor window select "Graduated Color" as the Legend Type. Select "Density" for the Classification Field. Select "Yellow Monochromatic" for the Color Range. Click Apply in the Legend Editor to apply your changes to the view. Leave the Legend Editor open.

Step 7   Change the Colors, Sizes, and Symbols of the Themes

Change the colors, sizes, and symbols of the themes below. Remember to click Apply in the Legend Editor after changing each theme.
    Countries theme: Transparent.
    Earthquake theme: Change the size to 10 and the color to blue.
    Historic Volcanoes theme: Change the symbol to a triangle and the size to 10 and the color to red.
    Recent Volcanoes theme: Change the symbol to a triangle and the size to 14 and the color to purple.

Step 8   Arrange the Themes in the View Window

Arrange the themes in your view window in the following order:
    Recent Volcanoes
    Historic Volcanoes
    Earthquakes
    Faults
    Countries
    Population Density

Step 9   Display the Themes in the View

Click on the raised box to the left of the Theme names to make a check mark and see the coverages displayed in the View window. You may want to turn off one or more themes in order to view the distribution of a particular theme. You may need to maximize or resize the ArcView window and the View window to see the entire view.

Step 10   Zoom to the Continent of Africa

Make the Countries the active theme and click the Zoom to Active Theme button button .

Step 11   Create and Print a Layout

Select three or four related themes and create and print a new Layout. For example, show recent and historic volcanoes, faults, and countries.

Questions

Note: You may want to turn the Historic Volcanoes and Earthquakes themes off to view the Recent Volcanoes and faults in Africa for some of the questions below:

Question 1   Use the Information button info or use the Open Theme Table Button table to open the Recent Volcanoes table and determine which volcano in Africa last erupted.

Question 2   Are the volcanoes in Africa located near plate boundaries or faults?

Question 3   Which country in Africa has the most historic volcanoes?

Question 4   Which country in Africa has the most recent volcanoes and is most at risk from volcanoes that may erupt in the future?

Question 5   What areas in Africa have high population densities, 5-9, and also have some risk from earthquakes and volcanoes?

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URL:http://rockyweb.cr.usgs.gov/outreach/africa/act5.html

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